REMARKS/ARGUMENTS

Reconsideration and allowance of this application are respectfully requested. Currently, claims 1-67 are pending in this application.

Rejection Under 35 U.S.C. §103:

Claims 1-8 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Nippert (U.S. '545) in view of Jokela et al. (U.S. '581, hereinafter "Jokela"). Applicant traverses this rejection.

In order to establish a *prima facie* case of obviousness, all of the claim limitations must be taught or suggested by the prior art. The combination of Nippert and Jokela fails to teach or suggest all of the claim limitations. For example, the combination fails to teach or suggest "the electronic sequencing controller has a configuration to select the mode of each chamber on successive cycles of working chamber volume so as to vary the time averaged effective flow rate of fluid through the machine," as required by independent claim 1. Similar comments apply to independent claim 7 and new independent claim 47.

With respect to the above-noted claim limitations, page 3, line 11 *et seq.* of the Office Action states that "The selection of each piston's mode must occur at some point in time, and each of these points could be considered the start of a cycle. In this way, the apparatus of Nippert chooses the pistons' modes on successive cycles."

The rationale expressed by the Office Action appears to deny that the "successive cycles" referred to in claims 1 and 7 are individual cycles of working chamber volume. By this Amendment, claims 1 and 7 have thus been amended to require "successive cycles of working chamber volume." Applicant submits that this clarifies that the electronic sequencing controller selects the mode of each chamber on successively cycles of working chamber volume.

The combination of Nippert and Jokela fails to teach or suggest selecting cycles of working chamber volume on successive cycles of working chamber volume from amongst an idling mode, a partial mode and a full mode to vary the time averaged effective flow rate of fluid through a fluid working machine – as required by independent claims 1, 7 and 47.

Nippert discloses a mode which at least resembles a partial mode. However, there is no teaching or suggestion in Nippert of making a decision as to which mode should be selected on each successive cycle of working chamber volume. Instead, Applicant submits that, given the possibility of partial cycles, one of ordinary skill in the art reading Nippert would use continuous partial cycles to provide the desired flow rate of fluid. If the required demand was 30% of the maximum output, for example, Applicant submits that of ordinary skill in the art reading Nippert would, if anything, output 30% of the maximum volume of each chamber during each cycle of working chamber volume.

Page 12, line 16 *et seq.* of the Office Action states: "One of ordinary skill will recognize this handicap of not being able to precisely match the account 'deficit' due to the lack of the 'partial' mode and therefore be motivated to the Nippert references which discloses the partial mode in Column 8, Lines 43-50: '...effectively pump a PORTION of their total volume and bypass the remaining portion... it is possible to pump a first portion of the volume, bypass an intermediate portion and pump the remaining portion of the total volume of fluid.'" However, Applicant submits that this statement from the Office Action reveals that Nippert solves a problem of being unable to precisely match an account deficit. Given the possibility of a partial pumping mode, taught by Nippert, without knowledge of the present invention, surely one of ordinary skill in the art would use the partial mode to precisely match the account deficit.

Applicant submits that Nippert actually teaches away from the invention of claims 1, 7 and 47. In particular, paragraph [0042] of Nippert describes a full pumping cycle. As described from line 9 of this paragraph, fluid flow into a piston as it moves from bottom dead center BDC to top dead center TDC. Line 19 of this paragraph states (emphasis added): "Simultaneously, fluid must be received from second inlet/outlet port 54 or low pressure side and delivered to the pressure chambers 48 from which the associated pistons 46 are moving from the top dead centre TDC position towards the bottom dead centre position BDC." Nippert effectively states that during a pumping cycle another piston must execute a corresponding pumping cycle 180° out of phase. This is necessary in the machine of Nippert which, as is apparent from Figure 2 or Figure 3, has both a pump and a motor connected to each other in a closed loop 30, 32 which does not include any kind of pressure accumulator. Volume must be conserved within this loop, thereby restricting the possible operating modes. Nippert has therefore described a machine in which for a cylinder to execute a pumping cycle, another piston must execute a corresponding pumping cycle 180° out of phase. *It is therefore not possible to change the mode from one cycle to the next as the mode of other cylinder would need to be changed at the same time*. However, decision points are not synchronized for different cylinders.

Like Nippert, Jokela fails to teach or suggest selecting cycles of working chamber volume on successive cycles of working chamber volume from amongst an idling mode, a partial mode and a full mode to vary the time averaged effective flow rate of fluid through a fluid working machine. Jokela appears to have been referred to in order to evidence that a desired flow rate can be one of the objectives in a pumping process. However, Jokela does not disclose a partial mode, let alone selecting cycles of working chamber volume on successive cycles of working chamber volume from amongst an idling mode, a partial mode and a full mode.

Accordingly, even if Jokela were combined with Nippert as proposed by the Office Action, the combination would not teach or suggest selecting from amongst an idle mode, a partial mode and a full mode on successive cycles of working chamber volume.

With respect to paragraphs 21-22 of the Office Action, the amount of fluid displaced is highly sensitive to the exact timing of valve actuations. This is due to the inconsistency of the transit time of each of the low pressure commutating valves from the start of the solenoid pulse to the actual event at which the valve finished closing (in other words, the stability of valve operation, as mentioned at page 4, lines 25 to 26 of the present application), the variability of this time from one nominally identical valve to another in a multi-cylinder pump, and the increased pressure sensitivity of very small partial strokes due to the finite fluid compliance of the dead volume within the working chamber. This inaccuracy is present across the full range of output flows, but is especially significant at low flow rates. For example, if a partial pumping cycle aimed to output 2% of maximum displacement, an error of 1% in the proportion of maximum displacement could lead to output of 1% or 3% of maximum displacement, a relative error of 50% of output. Applicant has inventively discovered that by selecting the mode on each cycle of working chamber volume, from amongst idle, partial and full modes, to vary the time average effective flow rate of fluid through the machine a more accurate output can be provided as any error in the volume displaced during a partial mode cycle would simply result in a different number of idle or full mode cycles, as appropriate, occurring on subsequent cycles of working chamber volume.

Paragraph 18 of the Office Action states that "Claims 1-6 are APPARATUS claims because they address a fluid working machine. Claims to an apparatus have to be STRUCTURALY different from prior art to distinguish them from the prior art." By this

Amendment, claim 1 has been amended to require "the electronic sequence controller *having a configuration to* select the mode of each chamber on successive cycles of working chamber volume...." This electronic sequence controller thus possesses a different structure – by virtue of being programmed, and thus having a configuration to, select the mode of each chamber on successive cycles of the working chamber volume as claimed. As previously held, "... *if a machine is programmed in a certain new and unobvious way, it is physically different from the machine without that program*; its memory elements are differently arranged. The fact that these physical changes are invisible to the eye should not tempt us to conclude that the machine has not been changed (emphasis added)." *In re Bernhart and Fetter*, 417 F.2d 1395, 1400, 163 U.S.P.Q. 611, 616 (C.C.P.A. 1969). Moreover, as stated in MPEP 2143.03, "*All* words in a claim must be considered in judging the patentability of that claim against the prior art (emphasis added)." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Accordingly, Applicant respectfully requests that the rejection under 35 U.S.C. §103 over Nippert and Jokela be withdrawn.

Claims 9 and 10 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Nippert in view of Jokela, and further in view of Salter et al. (U.S. '738, hereinafter "Salter"). Applicant traverses this rejection. Claims 9 and 10 depend from claim 7. Salter fails to resolve the above-described deficiencies of the Nippert/Jokela combination with respect to base independent claim 7. Applicant therefore requests that the rejection of claims 9-10 under 35 U.S.C. §103 be withdrawn.

New Claims:

New claims 11-67 have been added. New claims 11-24 depend directly or indirectly from base independent claim 7, dependent claims 28-43 depend directly or indirectly from base

independent claim 1, and claims 48-64 depend directly or indirectly from base independent claim 47. Applicant therefore submits that each of these dependent claims is allowable at least for the reasons discussed above with respect to base independent claim 1, 7 or 47 -- and for the further limitations recited therein.

New independent claims 25, 44 and 65 (as well as dependent claims 11, 30 and 51) require, *inter alia*, the operation of a fluid working machine as a motor. In contrast, Nippert simply does not disclose a partial motoring mode. A part volume pumping cycle is disclosed in paragraph [0047] with reference to the embodiment of Figure 4 and in paragraph [0054] with reference to the embodiment of Figure 5. However, no part volume motoring cycle is disclosed. A passing reference in line 4 of paragraph [0042] that it is recognized that [the described fluid pump] is also applicable as a fluid motor does not constitute a disclosure of a partial motoring mode.

Page 5, line 8 of the Office Action alleges that Nippert discloses a partial motoring mode which is "similar to partial pumping mode in that only a portion of fluid is used to actuate a motor, but the inlet leads from the high pressure manifold and the outlet leads to the low pressure manifold." This allegation is an unsupported assertion based on improper hindsight with knowledge of Applicant's own specification. Similarly, the Office Action's allegation on page 6 that "partial motoring mode includes closing the valve linking the cylinder to the high-pressure manifold and opening the valve linking the cylinder to the low-pressure manifold a small fraction after the top dead centre position of the piston (Partial motoring mode operates in a manner similar to partial pumping mode. Therefore it would be possible to use a first portion of the volume to create rotary motion, bypass an intermediate portion, and use the remaining portion of

the volume to create motion..." is also an unsupported assertion based on improper hindsight with knowledge of Applicant's own specification.

Indeed, the motoring cycle disclosed in Nippert is *incompatible* with the method of providing only a part of the maximum stroke volume disclosed in Nippert. In particular, paragraph [0044] of Nippert discusses a purported motoring mode. Applicant disagrees that Nippert has provided an enabling disclosure of a motoring mode at all. However, at the end of the purported motoring cycle disclosed in paragraph [0044], both of the ball checks are returned to their respective first valve seat. This will have the effect of sealing the working chamber. If the motoring cycle was cut short by closing the connection to the higher pressure manifold during the intake stroke, as the Office Action suggested then, as the described purported motoring cycle finishes with the ball checks returned to their respective first valve seat this would have the effect that the piston would be hydraulically locked. It would not move further an intake any further fluid. Thus, the purported motoring cycle is fundamentally incompatible with the partial stroke methods disclosed in Nippert. Nippert states in paragraph [0055] that the displacement of the fluid pump can be varied by "pump[ing] only a portion of their total volume and bypass[ing] the remaining portion to the low pressure side." However, it would be impossible to combine this with the purported motoring cycle as the chamber would be sealed. Thus, one of ordinary skill would not only not think to provide a partial displacement motoring mode based Nippert's disclosure and it would not be apparent from Nippert how this could be achieved.

With respect to claims 11, 30 and 51, Nippert does not disclose or suggest the operation of a fluid-working machine as a motor in which the valves of each chamber are operated in one

of an idling mode, a partial mode in which only part of the usable volume of the chamber is used, and a full mode in which all of the usable volume of the chamber is used.

Claims 12, 31 and 52 depend from claims 11, 30 and 51, respectively. In addition to the points raised above with respect to claims 11, 30 and 51, even if Nippert discloses or suggests a partial motoring mode (which Applicant denies), it all references to partial delivery cycles refer to displacing a portion of the fluid within a cylinder to the high pressure manifold and a portion to the low pressure manifold. There is no teaching or suggestion which would in any way suggest closing the valve linking the cylinder to the high-pressure manifold and opening the valve linking the cylinder to the low-pressure manifold.

With respect to claims 19, 38 and 59, Nippert does not disclose a partial mode in which valve actuations are delayed until almost the end of the stroke. Nippert only refers to the possibility of pumping an initial portion of the volume of a piston or bypassing an intermediate portion and does not disclose delaying valve actuations in this way. By delaying valve actuations in this way, the rate of change of working chamber volume will be low, facilitating valve actuation.

The combination of Nippert and Jokela fails to teach or suggest selecting cycles of working chamber volume on successive cycles of working chamber volume from amongst an idling mode, a partial mode and a full mode to vary the time averaged effective flow rate of fluid through a fluid working machine -- as required by independent claims 1, 7 and 47.

New independent claim 27 requires, among other things, "wherein at low flows, operating the valves includes an operation sequence composed of partial strokes in which only part of the usable volume of the chamber is used and idling modes with the fraction of the two

modes reflecting a demand level." Independent claims 47 and 67 require similar limitations. The cited prior art fails to teach or suggest this limitation.

Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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